



application of the adhesive onto the article. The article to be provided with the adhesive moves past the applicator unit. When doing so, the adhesive is applied by the applicator unit onto the article along a line which extends in the transport direction of the article through the device. As a result of the configuration according to the invention, a complex control of the applicator unit as a function of the transport speed of the article is not required.

[0008] In another embodiment, at least one vacuum drum is provided in the transport path of the article to be transported and transports the article in a direction toward a stop. In this configuration, by means of the vacuum drum the article is transported against a stop and is aligned at the stop. The vacuum drum is advantageously continuously rotated so that a rebound action of the article on the stop is prevented.

[0009] In yet another embodiment of the present invention, the device has at least one deflection unit for changing the transport direction of the article. In this configuration, the deflection unit for the article has a roller pair whose rollers are driven in opposite directions relative to one another. The article, which is supplied in one direction, is received between the rollers of the roller pair and is transported farther by them in another direction.

[0010] In yet another embodiment of the invention, the device has at least one folding unit with at least one folding element which is adjustable in a direction transverse to the transport direction of the article. By means of this configuration, a portion of the article is folded by adjusting the folding element in order to produce, for example, an envelope from a paper sheet.

## Brief Description of Drawings

[0011] In the drawing:

[0012] Fig. 1 is a schematic illustration of a plan view onto an enveloping device according to the present invention.

[0013] Fig. 2 shows a schematic and enlarged view in the direction of arrow II of Fig. 1.

[0014] Fig. 3 is a plan view onto a deflection unit of the device according to the invention.

- [0015] Fig. 4 is a plan view onto an accumulator of the device according to the invention.
- [0016] Fig. 5 is a view in the direction of arrow V in Fig. 4.
- [0017] Fig. 6 is a view in the direction of arrow VI in Fig. 4.
- [0018] Fig. 7 is a schematic illustration of a folding unit of the device according to the invention.
- [0019] Fig. 8 is a plan view onto a paper sheet with an adhesive pattern applied by the device according to the invention in connection with using a hot-setting adhesive.
- [0020] Fig. 9 is an illustration corresponding to Fig. 8 showing the adhesive pattern when employing a cold-setting adhesive.
- [0021] Fig. 10 is a plan view onto an insert folding device of the device according to the invention.
- [0022] Fig. 11 is a side view of the insert folding device according to Fig. 10.
- [0023] Fig. 12 is a front view of the insert folding device according to Fig. 10.

## Detailed Description

- [0024] The device is provided for the purpose of enveloping sheets of paper, cardboard, plastic and the like in an envelope which is produced in the device from a sheet of paper, carton, plastic or the like. The illustrated embodiment will be explained in connection with paper sheets 1.
- [0025] The device is supplied, for example, with printed paper sheets 1 which may be supplied individually or as an endless web uncoiled from a roll. In the illustrated embodiment according to Fig. 1, the paper sheets are supplied first as an endless web uncoiled from the roll and are cut, as is known in the art, in the longitudinal and transverse direction of the roll. The resulting paper sheets 1', 1'' are used as inserts (paper sheets 1'') as well as for producing an envelope (paper sheets 1') for these inserts. The paper sheets 1'/1'' are transported first in their longitudinal direction to a deflection unit 3. The transport direction of the paper sheets is changed at this deflection unit 3. As illustrated in Fig. 1, the paper sheets are deflected by 90 ° relative

to the supply direction by the deflection unit 3 and then transported farther.

[0026] The paper sheets 1', 1" are transported perpendicularly to their longitudinal direction into a feeder 4 and stacked in the illustrated embodiment. The configuration and function of the feeder 4 is known in the art and is therefore not described in detail in this context. The individual paper sheets 1'/1" are stacked in the stack 2 in an imbricated arrangement and, after individualization on a stop 11, are supplied perpendicularly to their longitudinal direction to an accumulator 5. The accumulator 5 has a stop 6 on which the paper sheets 1" come to rest with their longitudinal side leading in the transport direction. In the accumulator 5 the paper sheets 1" are collected to individual sets which are to be enveloped in the envelope 1'.

[0027] As illustrated in Fig. 2, the stop 6 for the paper sheets 1" is formed by an edge of the plate-shaped support 7 for the paper sheets 1" angled at a right angle. The accumulator 5 is provided with a vacuum drum 8 which is arranged on a horizontal axis extending perpendicularly to the feeding direction of the paper sheets 1" coming from the feeder 4. The vacuum drum 8, as illustrated in Figs. 4 and 5, has openings 9 in its peripheral surface which are arranged uniformly distributed about the periphery of the vacuum drum and via which vacuum can act on the paper sheets 1". The vacuum drum 8 is connected to a vacuum source and is rotated continuously about its axis such that the paper sheets are transported against the stop 6 and are held thereat. The vacuum drum 8 may have a friction coating on its peripheral surface.

[0028] For paper sheets of different weight the magnitude of the vacuum can be advantageously adjusted. The vacuum drum 8 can be provided underneath or above the paper sheets 1" to be transported, depending on whether they are to be stacked underneath or on top. Because of the constant rotary movement of the vacuum drum 8, the paper sheets are reliably pressed against the stop 6 and rebound of the paper sheets is prevented in this way. The vacuum drum 8 is advantageously provided with a friction coating so that the respective paper sheet can be reliably transported. The vacuum drum 8 in the accumulator 5 has correlated therewith at least one sensor 31 (Fig. 4) which is, for example, a photocell. As soon as the paper sheet 1" is positioned in the area of the sensor 31 and is detected by it, the vacuum of the vacuum drum 8 is switched off.



[0032] Since the paper stack 2 also contains the paper sheet 1' for manufacturing the envelope, this paper sheet, when transferred from the feeder 4 to the accumulator 5, is deflected by a diverting device 10 (Fig. 1 and Fig. 2) to a different transport path than the inserts 1" to be enveloped. The diverting device 10 is connected to a read head (not illustrated) in the feeder 4 with which the paper sheets 1', 1" can be read, for example, by means of a bar code. Depending on the bar code, the respective paper sheet is then deflected by means of the diverting device 10 to the support 7 of the accumulator 5 or to a descending transport path 14 on which the paper sheet 1' is transported in the area below the accumulator 5 to an adhesive applicator device 15. The paper sheets 1" positioned on the support 7 of the accumulator 5 are transported by the vacuum drum 8 against the stop 6 in the described way.

[0033] As illustrated in Fig. 1, the adhesive application device (adhesive station) 15 is provided with two adhesive applicator units 16, 17 positioned at a spacing from one another in a direction perpendicular to the transport direction of the paper sheet 1'. Three adhesive strips 18 to 20 (Fig. 8) are applied onto the paper sheet 1' by the adhesive applicator units 16, 17. The adhesive strips extend parallel to one another and to the narrow sides 21, 22 of the paper sheet 1'. The adhesive strips 18 to 20 have different lengths. The length of the adhesive strips 18 to 20 depends on the shape of the flaps which result upon folding of the paper sheet.

[0034] While the inserts 1" to be enveloped in the envelope are collected in the accumulator 5, the adhesive application is carried out in the adhesive application device 15. After adhesive application is complete, the paper sheet 1' is guided between two rollers 23, 24 (Fig. 2) whose axes of rotation are positioned horizontally and perpendicularly to the supply direction of the paper sheet 1' and by which the paper sheet 1' is moved from a horizontal position into an upright position. The transport of the paper sheet 1' via the transport path 14 into the adhesive application device 15 is carried out as is known in the art, for example, by means of a vacuum belt 25, illustrated in an exemplary fashion in Fig. 3, or by means of transport rollers.

[0035] The paper sheet 1', which has been deflected by 90 ° into an upright position, is conveyed into a holding and guiding unit 27 which has parallel vertically extending sidewalls 28, 29 between which the paper sheet 1' is positioned. The sidewalls 28, 29

secure the paper sheet 1' in its upright position. In order for the paper sheet 1' to reach reliably the unit 27, the lower end of the sidewall 28 is bent in the direction toward the roller 23. The sidewall 29 remote from the roller 23 is straight across its height and projects past the bent end of the sidewall 28 in the downward direction. In this way it is ensured that the paper sheet 1' reaches the area between the two sidewalls 28, 29 without the risk of being caught. The upper ends of the two sidewalls 28, 29 are connected by a transverse wall 30. The transverse wall 30 serves advantageously as an adjustable stop for the paper sheet 1'. The paper sheet 1' rests on the transverse wall 30 with one longitudinal side.

[0036] For transporting the paper sheets 1' until it rests against the transverse wall 30 at least one vacuum drum 25 is provided (Figs. 1 and 2) which is identical to the vacuum drum 8 of the accumulator 5. In the unit 27 the vacuum drum 8 can be rotated about a horizontal axis which is parallel to the axes of rotation of the rollers 23, 24. The vacuum drum 8 is driven in rotation such that the paper sheet 1' is moved upwardly into a contact position at the transverse wall 30. The vacuum which acts via the openings 9 in the vacuum drum 8 onto the paper sheet 1' is advantageously adjustable. In this way, the vacuum can be adjusted in a simple way to the weight of the paper sheet.

[0037] The vacuum drum 8 of the unit 27 is arranged at such a spacing to the rotatably driven rollers 23, 24 that the vacuum drum 8 has already engaged the paper sheet 1' when the paper sheet 1' is still positioned between the two rollers 23, 24. In this way, a reliable transport of the paper sheet 1' up to the point of contact on the transverse wall 30 is ensured.

[0038] In the holding and guiding unit 27 the upright paper sheet 1' is transported farther by transport rollers (not illustrated) perpendicularly to the feed direction determined by the vacuum drum 8 in the transport direction 34 (Fig. 1). In the above described way, the vacuum of the vacuum drum 8 is advantageously switched off when the paper sheet 1' is engaged by the transport rollers for which purpose a sensor (not illustrated) is employed which detects the supplied paper sheet in the unit 27 and effects switching off the vacuum.

[0039] The upright paper sheet 1' is guided by the transport rollers (not illustrated)

between two rollers 35, 36 which are driven in rotation about vertical axes and supply the paper sheet 1' to a second adhesive application device (adhesive station) 37. The adhesive strips 38 and 39 (Fig. 8) are applied by the adhesive application device 37 onto the upright paper sheet 1'. The strips 38, 39 extend at a minimal spacing parallel to the two longitudinal edges of the paper sheet 1'. Both adhesive strips 38, 39 begin at the narrow side 21 of the paper sheet. The adhesive strip 38 is significantly longer than the oppositely positioned, parallel extending adhesive strip 39. The length of the two adhesive strips 38, 39 depends on the flaps resulting from folding the paper sheet for producing the envelope.

[0040] After application of the adhesive in the adhesive application device 37, the paper sheet 1' moves between two vertical, rotatably driven rollers 40, 41 for manufacturing the envelope; the rollers 40, 41 transport the paper sheet between two vertical sidewalls 42, 43. In the transport unit 44 provided with these sidewalls the upright paper sheet 1' is transported to two further vertical and rotatably driven rollers 45, 46 having arranged downstream thereof at a minimal spacing in the transport direction two further vertical, rotatably driven rollers 47, 48. The paper sheet 1' is supplied to a deflection unit 49 by means of the rollers 47, 48 and the deflection unit 49 transports the paper sheet 1', after deflection by 90 °, in the transport direction 50 into the insert folding device 51 which comprises rollers 52, 53 in front of which the paper sheet 1' provided with adhesive is positioned.

[0041] During application of the adhesive onto the paper sheet 1' to be used for manufacturing the envelope, the paper sheets collected as a set within the accumulator 5 are supplied to a folding device 54 with which the paper sheets 1" are folded in a manner known in the art to the size of the envelope to be produced. The folded paper sheets 1" are transported with transport belts 55 or the like in the direction toward the insert folding device 51. In the area adjacent to the transport devices (belts) 55, insert feeders 56 can be provided which supply inserts transversely to the transport direction of the transport belts 55 to the folded paper sheets 1". The transport belts 55 transport the folded paper sheets 1" on an insert transport path parallel to the paper sheet 1' which is transported on a branch path via the transport unit 44 and the deflection unit 49 parallel to the folded paper sheets 1".



[0042] In the insert folding device 51 the paper sheet 1', whose adhesive strips 18 to 20, 38, 39 have dried in the meantime, and the documents 1", 57 to be enveloped are combined. The paper sheet 1' is supplied to the insert folding device 51 such that its narrow sides 21, 22 are positioned at an obtuse angle to the transport direction of the transport belts 55. In the insert folding device 51 a first fold is produced so that a triangular flap 58 is formed which is placed on top of the documents 1", 57. The documents 1", 57 are positioned with their longitudinal edge (Fig. 8) on the folding edge 58a. In Fig. 8 the position of the documents 1", 57 is illustrated by a dotted line.

[0043] Upon transfer from the deflection unit 49 to the insert folding device 51, the paper sheet 1' is transported downwardly at a slant, as illustrated in Fig. 12. The slant angle is selected such that the folding edge 58a, along which the paper sheet 1' is folded within the insert folding device 51, has the required position for the folding process. The folding edge 58a is positioned at an acute angle relative to the longitudinal side 104 of the paper sheet 1' and to the narrow side 21 adjoining it at a right angle. As illustrated in Fig. 12, the paper sheet 1 is deflected in the deflection unit 49 from its upright vertical position into the slanted position. The insert folding device 51 is provided with a stop 105 for the paper sheet 1'. The stop 105 has two stop parts 106, 107 positioned at a right angle to one another. The paper sheet 1' comes to rest with its narrow side 22 on the stop part 106 and is positioned with its longitudinal side 108 on the stop part 107. The two stop parts 106, 107 are positioned at a slant relative to the roller gap between the folding rollers 52, 53 such that the folding edge 58a between the two folding rollers 52, 53 can be produced.

[0044] A folding blade 109 is arranged upstream of the two folding rollers 52, 53 on which the insert 1" is supplied transverse to the feed direction of the paper sheet 1' to the folding rollers 52, 53. Advantageously, the folding blade 109 is adjustable into the area between the two folding rollers 52, 53. The edge 107 of the folding blade 109 facing the roller gap serves for assisting the folding precision with which the paper sheet 1' is folded between the folding rollers 52, 53 along the folding edge 58a. The insert 1" is supplied together with the paper sheet 1' simultaneously to the two folding rollers 52, 53, and the paper sheet 1' is pressed by means of the transversely supplied insert 1", and assisted by the folding blade 109, into the roller gap between the two folding rollers 52, 53 which engage the paper sheet 1' and in this way fold the

triangular flap 58 in the paper sheet 1'.

[0045] Downstream of the insert folding device 51 a diverting device 59 is provided with which documents and envelopes which have been combined wrongly can be removed without having to stop the device. Since the inserts 1", 57 and the paper sheet 1' used for producing the envelope are transported in the described way separately to the insert folding device 51, these inserts and the paper sheet 1' can be monitored with respect to proper combining of the inserts and the paper sheets 1', for example, by means of printed labels such as a bar code label. Moreover, it can be monitored whether the insert and the paper sheet for producing the mailing are even present. Sensors such as photocells can be used for monitoring. When they indicate an error, the corresponding insert 1", 57 and/or the paper sheet 1' can be deflected, preferably upwardly, while the properly combined inserts and paper sheets (future envelopes) are transferred onto a transport device 60. The upwardly deflected inserts and/or paper sheets (future envelopes) transported in the area above this transport device 60 are then removed from the enveloping device.

[0046] The transport device 60 has two parallel positioned endless circulating vacuum belts 61, 62 (Figs. 1 and 7) which are provided over their length with openings 63, 64. In the illustrated embodiment, these openings 63, 64 are positioned at a minimal spacing behind one another at half the width of the vacuum belts 61, 62. Via the openings 63, 64, vacuum can act on the paper sheet 1' positioned thereon which is thus reliably transported together with the insert 1", 57 and the folded flap 58. As illustrated in Fig. 1, the paper sheet 1' projects laterally past the two vacuum belts 61, 62. The projecting lateral flaps 65, 66 of the paper sheet 1' are folded by a downstream folding unit 67. The folding unit 67 has two erecting means in the form of wings 68, 69 (Fig. 1) oriented counter to the supply direction and arranged divergently with which the lateral flaps 65, 66 are erected. Downstream of these wings 68, 69, the folding unit 67 is provided with freely rotating pressing-down rollers 70, 71 (Fig. 1 and Fig. 7) which are positioned at a minimal spacing in the area above the vacuum belts 61, 62 and are adjustable transversely to the transport direction of the vacuum belts in the direction of the indicated double arrows 72, 73. As soon as the upright lateral flaps 65, 66 of the paper sheet 1' reach the area of the pressing-down rollers 70, 71, they are adjusted relative to one another such that the flaps 65, 66 are

folded over. The folding edges 74, 75 are positioned, in a plan view onto the transport device 60, at a minimal spacing adjacent to the respective neighboring vacuum belts 61, 62. The axes of rotation of the rollers 70, 71 are positioned parallel to the conveying direction of the vacuum belts 61, 62. In the area above the transport path the folding unit 67 is provided with a holding-down device 101 which secures the paper sheet 1' and the insert 1'', 57 positioned thereon during the folding process. The longitudinal edges 102, 103 of the sheet metal-shaped holding-down device 101 extending in the conveying direction facilitate the folding process during folding of the lateral flaps 65, 66 because the flaps are folded along these edges 102, 103. In order to be able to produce different envelope sizes, the holding-down device 101 is preferably adjustable so that the spacing between the longitudinal edges 102, 103 can be changed.

[0047] A heating unit 76 is provided in the transport direction of the vacuum belts 61, 62 behind the folding unit 67 and comprises a heating pallet 77, 78 (Fig. 1). They are placed onto the overlapping edge areas of the folded flaps 58, 65, 66. In this area the folded flaps are resting on one another with their adhesive strips. By applying heat and pressure, the folded flaps 58, 65, 66 are glued to one another by means of the heating pallets 77, 78. At this stage of the process, only the flap 79 of the paper sheet 1' projecting to the rear in the transport direction of the vacuum belts 61, 62 is not yet folded.

[0048] As illustrated in Fig. 1, in the folding unit 67 the pressing-down rollers 70, 71 are present in pairs. The two pressing-down rollers 70, 71 on each side of the transport device 60 are moved independently from one another in the adjusting direction 72, 73 (Fig. 7). This has the advantage that the first rollers 70, 71 in the supply direction of the paper sheet 1' return immediately after the folding process into their initial position in order to receive the subsequent paper sheet 1' with the inserts 1'', 57. The pressing-down rollers 70, 71 downstream in the transport direction remain in the advanced position relative to the vacuum belts 61, 62 until the paper sheet 1' with the folded-over lateral flaps 65, 66 has been transported farther to the heating device 76. In this way, it is ensured that the lateral flaps 65, 66 of the paper sheets 1' can be reliably folded over even when the paper sheets with inserts are supplied in a rapid sequence.





time the corresponding envelope 1' is produced of a paper sheet. The paper sheet provided for producing the envelope can already be provided with the address, optionally also the sender's address and other information. The adhesive is applied onto the paper sheet 1' in two steps by means of the two adhesive application devices 15 and 37 which are arranged upstream of the insert folding device 51. In this way, a complex slanted application of the adhesive can be avoided. In the two adhesive application devices 15, 37 the adhesive is applied parallel to the lateral edges of the paper sheet 1' (Fig. 8). The employed adhesive is a hot-setting adhesive.

[0056] It is also possible to employ a cold-setting adhesive and to thus eliminate the heating units. The cold-setting adhesive, however, can be applied only downstream of the insert folding device 51. The cold-setting adhesive in this case is applied advantageously in two steps. First, the lateral flaps 65, 66 of the paper sheet 1' are provided with adhesive within the area upstream of the folding unit 67. The adhesive strips 20, 39 are applied according to Fig. 9. The second adhesive application is carried out after the perforation action in the perforation unit 84 has taken place before folding of the flap 79 in the folding unit 86 has been carried out. Between the perforation unit 84 and the folding unit 86 the adhesive strips 18, 19, 38 are applied. Subsequently, the flap 69 with the applied adhesive is then folded over in the folding unit 86.

[0057] For applying the cold-setting adhesive multi-head adhesive applicators can be used which can apply droplets of adhesive at spot locations at minimal spacing to one another. The corresponding applicator nozzles can be controlled individually. When employing such multi-head adhesive applicators it is also possible to carry out a slanted adhesive application, i.e., the adhesive tracks can also extend at a slant to the lateral edges of the paper sheet 1' in that the corresponding applicator nozzles are closed or opened. The adhesive strips 18 to 20, 38, 39 in this case can be applied with a single adhesive station.

[0058] The transport device 93 with flattened transport rollers 94 (Figs. 4 to 6) can be employed in the enveloping device where the transport direction of the paper sheets has to be changed, preferably by 90°. In this way, such a transport device can be provided also in the area of the stop 80, on which the partially closed envelope 1' after

passing through the heating unit 76 will come to rest, or in the area of the holding and guiding unit 27.

[0059] With the described vacuum drum 8, 81, folded or unfolded paper sheets 1' with or without insert 1", 57 can be transported. Instead of paper sheets 1' it is also possible to process sheets of plastic, cardboard, and the like.

[0060] While specific embodiments of the invention have been shown and described in detail to illustrate the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.